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THE TECHNIC.

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GYM work has begun for the track team, and considerable indoor work will be done preliminary to track work until the ground becomes settled. The management is desirous of arranging an indoor meet in the near future with I. S. N. A field meet is also expected between the two institutions later in the season. We have plenty of good material, and a winning team is an assured fact.

IT is very annoying for a man desiring information on a certain subject to go to the library and find the books relative to that subject missing. In many cases this is unavoidable as the rules allow a student to draw books to be kept out a certain length of time. But the continued use of a book by a student is unfair to others and defeats to a great extent the aim of the library. Restrictions should be placed on the time a book may be retained by a student and enforced in every case.

SINCE the last issue of THE TECHNIC two members have been added to the editorial staff. Mr. Clifford W. Post, '07, was elected Assistant Business Manager and Carl B. Andrews, '08, Freshman Local. Freshmen will please note this and keep Mr. Andrews informed of class events.

TUESDAY, January 24th, was the occasion of a noisy demonstration on the part of the Seniors. Promptly at four o'clock a babel of unpleasant sounds made the old walls of the academic building shake. That the time of an affectionate farewell had arrived, was announced by an alarm clock in the rear of the room. This was followed by nine 'rahs for Dr. Gray, and then the main celebration began. Little horns and big horns, little bells and big bells, all joined in one grand discord. Above the din rang the clear notes of Mexico Wood's cavalry bugle. The room was not large enough to hold the noise, so the class poured out into the hall, where the rest of the Faculty were congratulated on being rid of the class of '05 in the recitation rooms. A parting speech by Professor Hathaway was a proof of the good feeling that existed between the Faculty and the class.

ONE of the greatest sources of information is the magazines, and every student should make a practice of devoting a portion of his time to the reading of them. When the schedule is being made out find time for a couple of hours' reading per week, and give it to reading articles by men prominent in engineering. All of the best periodicals are in the library, and a student interested in any branch will find papers there bearing on his subject.

THE LOCAL PRESS.

THE interest, or rather disinterest, that the local press has taken in our athletic affairs, and the character of the few and meagre details which have now and then appeared in their columns, have brought forth a great deal of unfavorable comment from the student body and many of its friends. In accord with the appeal of many of our students, we feel constrained to utter a few sentiments in regard to this matter.

The Institute does not need and does not desire any broadcast advertising through the sporting columns of any publication. Neither does it foster and support athletics for any such purpose. But there are many people who keep in touch with their friends in the Institute mainly by means of the local press, and who watch and depend upon the same for the announcement and account of our games, contests and other exploits.

For this reason, if for no other, it is desired that the representatives of the press, who manifest so much interest in our welfare when seeking "comps," would manifest a little of the same spirit after the game and print the account of it, and the other items they seem to want, intelligibly and correctly, that we may not be misrepresented to our friends and the public.

Oft-times our approaching games receive but the slightest mention; and accounts of games that have taken place are of such a character that they are received with complete disgust by our students. Likewise the good plays and pleasant features are almost unnoticed, while anything unpleasant that may have happened is sure to receive unlimited space.

In conclusion, it is hoped that the representatives will cling to some of their professed interest in our affairs long enough to print the notices and results of our athletic contests as they should be printed, and at least do as well by us as some of their contemporaries in the neighboring cities.

Type M. T. Controller.

By HARRY S. RICHARDSON.

THE problem presented to the mill table controller is that of severe service, consisting of sudden and rapid applications and reversals of load, combined with requirements for high efficiency and safety of operation as well as minimum cost of maintenance.

Heretofore the principal trouble encountered in electric driving was the burning of armatures or the straining or breaking of the driving mechanism in some part, the greatest danger lying in reversing the motor at high speeds, the safety of the operation depending on the care and skill of the operator.

To meet these conditions and eliminate the difficulties the M. T. controller is especially adapted.

Its general function is first to provide means for starting and accelerating the motor up to full speed or any desired lower speed, then to bring the motor to rest quickly by a braking action and immediately start and accelerate the motor in the reverse direction and again bring it to rest, the continued action being a repetition of this cycle of operations.

The braking action consists in general of making such connections that the motor, by reason of its momentum, will be caused to act as a generator, forcing current through a circuit in which there is a properly proportioned resistance until the motor is brought to rest by such action.

The controller consists of a magnetic switch controller and an operating, or master controller. The former is made up of a double pole switch for disconnecting the system from the service line, and a series of electro-magnetic clapper type switches, the size of which depending on the h.p. to be provided for, and number being determined by the conditions to be met, viz., the number of steps in building up the motor speed or the number of running points desired, and whether the reversal of the armature current is to be effected on the operating controller or by means of these switches. In systems up to and including 50 h.p., the reversal is accomplished on the operating controller, while above 50 h.p., on account of the heavy currents, it is effected by specially arranged and controlled switches.

The clapper type switch consists essentially of an arm pivoted at the bottom constituting one terminal, and carrying at the upper end both a copper and carbon contact, the latter being made so as to take the final break of the current and thereby providing a means for a cheap and easy renewal of contacts worn out by arcing. This contact is also provided with a magnetic blow-out, a series coil for that purpose being arranged on the back of the slate. The arm of the switch is normally held open by a spring and is closed by the action of a solenoid, the coil of which is energized in one of the several ways to be later described. The switch is quick in its action and has a large air gap separating the two parts of the contact, which, with the blow-out feature, reduces the arcing to a minimum. The switch in its entirety is built to withstand heavy and continuous service, and is mounted on a slate base with the terminals, solenoid and blow-out coil on the back. All parts can be readily replaced affording a low cost of repairs.

The operating controller consists of an arm carrying copper fingers, which ride on contacts concentrically arranged on a slate face, and thus furnish current from one side of the line which is connected to one of the contacts, to the solenoids of the clapper switches in the order desired. This is called the speed-control face, and the great flexibility which it permits in adapting it to any desired conditions is one of the advantages of this type of controller.

As mentioned above, for capacities up to 50 h.p. the operating controller reverses the armature current directly, and for this purpose it is provided with another arm and slate carrying larger fingers and contacts, forming the reverse face which is operated simultaneously with the speed-control face and by means of the same handle. However, when the current is reversed by clapper switches, the solenoids of those switches have corresponding contacts on the speed-control face of the operating controller which then handles only solenoid currents, this arrangement having the advantage of greater safety and convenience.

To make the controller independent of the operator in building up the speed of the motor, a set of automatically operated switches is used, which, by short-circuiting portions of the starting resistance, allow current to be applied to the motor at times and in amounts consistent with its ability. The principle upon which the action of these switches depends can be best understood by reference to sketch No. 1, which represents a series motor and bank of resistance, AE, on a 200 volt circuit, and the solenoids of the clapper switches connected at different points in the circuit, as at B, C, D and E. The operating controller inserted between the solenoids and line is omitted for simplicity. Suppose the resistance, AE=1 ohm and is equally divided into four sections. A current of $\frac{200}{1}$=200 amps. will flow and the voltage on coil 1 is 200 volts minus the drop through resistance AB, or 200—(200 x .25)= 150V; that on coil 2 is 200V minus the drop through AC, or 200—(200 x .5)=100.

Similarly, the voltage on coil 3 is 50, and then on coil 4 is 0.

Thus each coil has a different voltage impressed on its terminals. When the motor starts and begins to accelerate, the current diminishes, thereby decreasing the drop through the resistance and raising the voltage on the coils. If the latter are made and adjusted to operate at the same voltage then they will act successively and at a time when the voltage has increased to the required value. For example, if the motor requires a current of 160 amps. to drive it, it will speed up until the current is reduced to that amount, at which time the voltage on coil 1 will be 200—(160 x .25)=160V, and if the solenoids are constructed to operate at that voltage, solenoid 1 will close. This short-circuits the resistance AB and the motor accelerates under the increased current, which then begins immediately to decrease until 160 amps. is reached; solenoid 2 will then operate, the action being similar for coils 3 and 4, the closing of 4 putting the motor directly on the line. The value to which the current drops when the automatic switches operate may be regulated by adjusting the spring or air gap of the switch for different voltages, or, keeping the adjustment the same, the terminal of the solenoid may be applied at any point in the circuit to correspond to different values of current.

The advantages which this system has over the one previously used to accomplish the same result is shown by reference to sketch No. 2, which differs from the preceding sketch in that the positive terminals of the coils are all connected at E. With this arrangement, using the values taken in the previous case, when the current=160 amps., the voltage on all the coils= 200—(160 x 1)=40V, at which solenoid 1 must be designed to operate. As before, this short-circuits resistance AB, and when the current has again fallen to 160 amps. the solenoids are impressed with a voltage of 200—(160 x .75)=80V, at which solenoid 2 must operate. Similarly solenoid 3 must act at 120V and solenoid 4 at 160V. In addition, all the solenoids have to withstand practically the line voltage of 200 when the motor is up to full speed. This and the fact that the coils must be wound for different voltages or have their air gaps adjusted between wide limits, makes the design of the switches difficult and expensive at best.

These objections are entirely obviated by the arrangement in sketch 1. The switches are made similar in every respect, but are capable of both a spring and air gap adjustment over a short range.

This simplifies and lessens the expense of the design and installation of the controller.

If it is desired to have running points corresponding to one or more of the above switches, one terminal of each of the solenoids will have a corresponding contact on the speed-control face of the operating controller with a suitable star wheel; but if no intermediate running points are

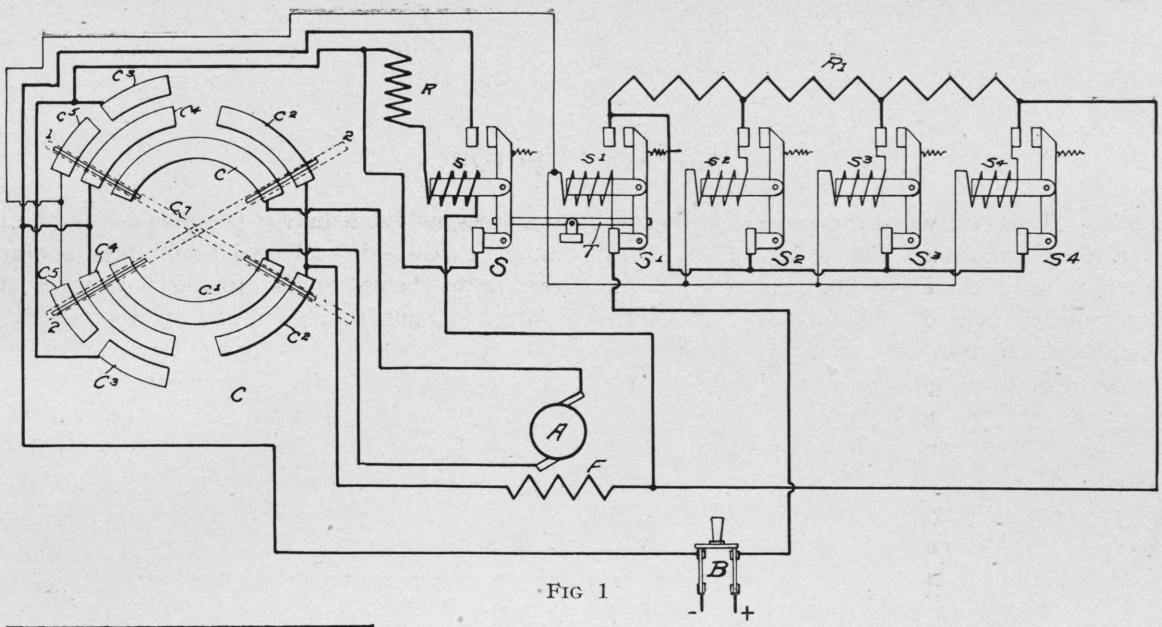


FIG 1

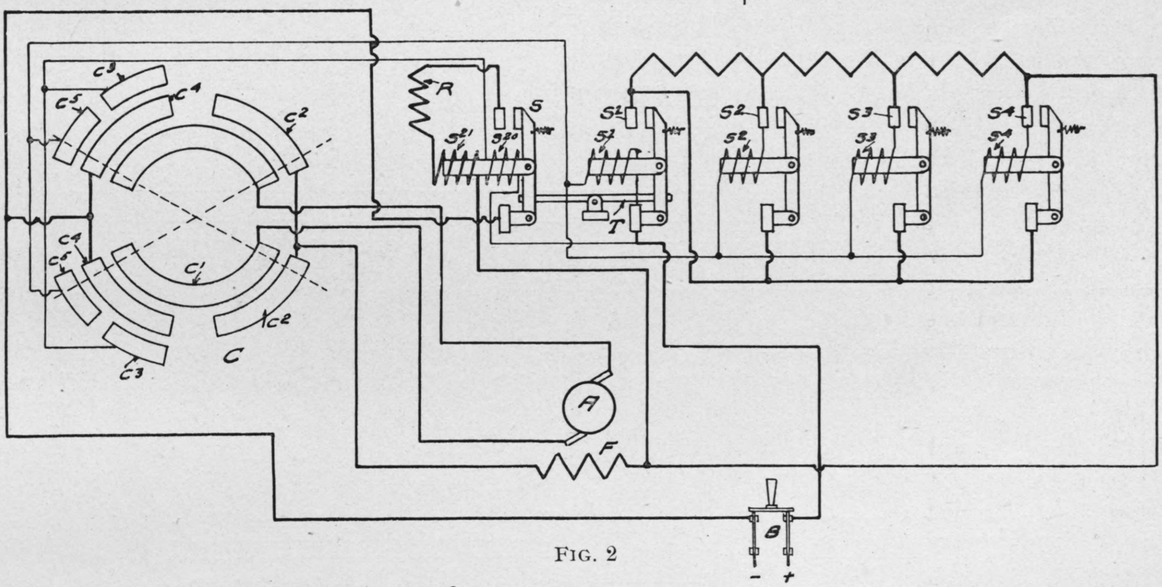


FIG. 2

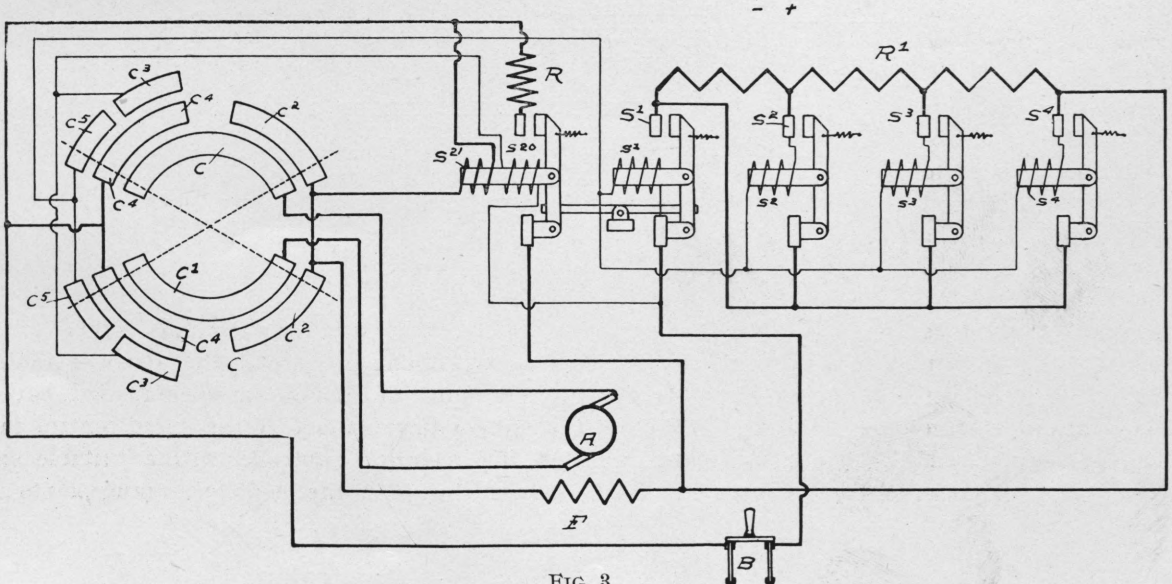


FIG. 3

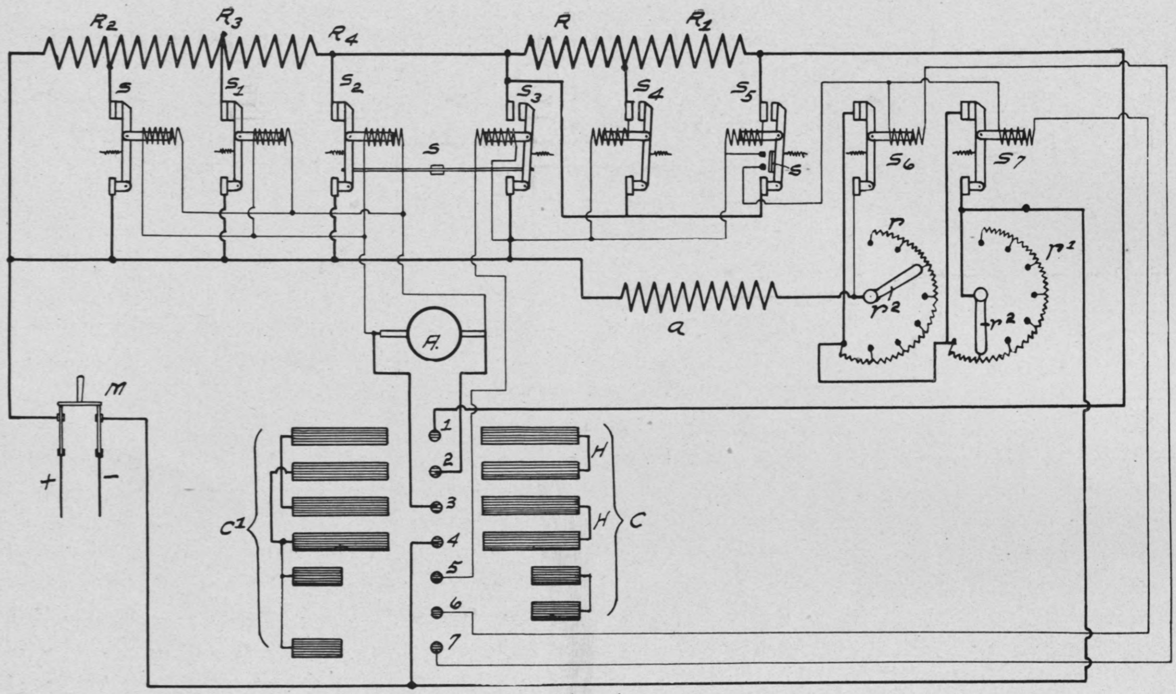


FIG. 4

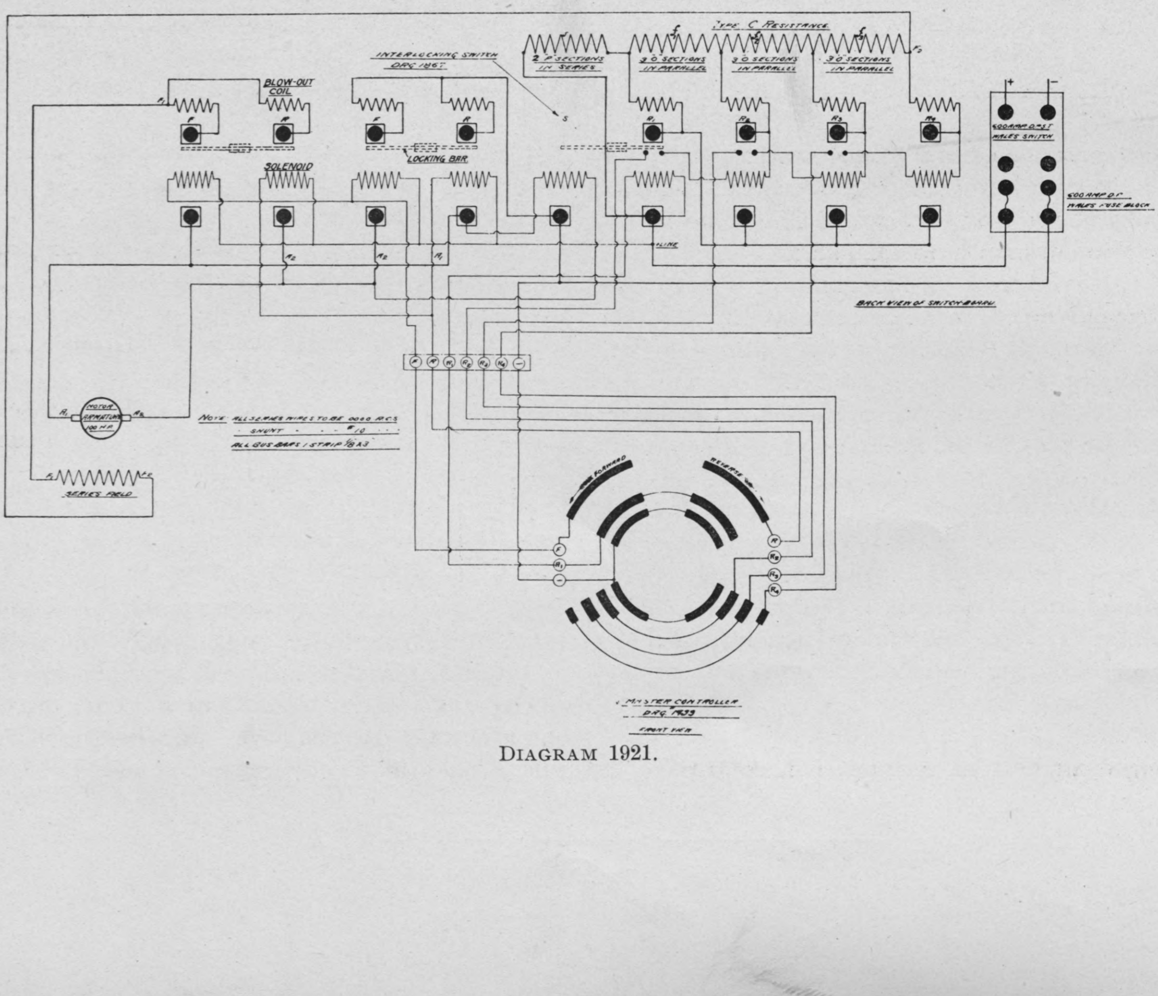
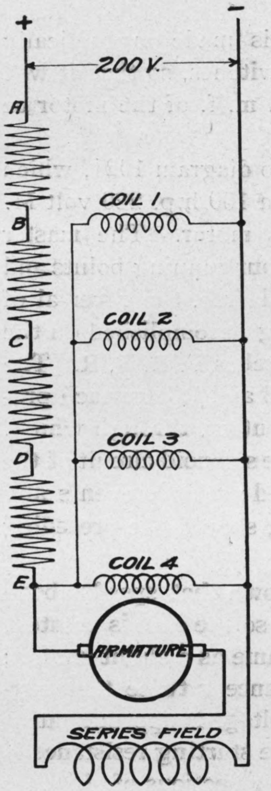
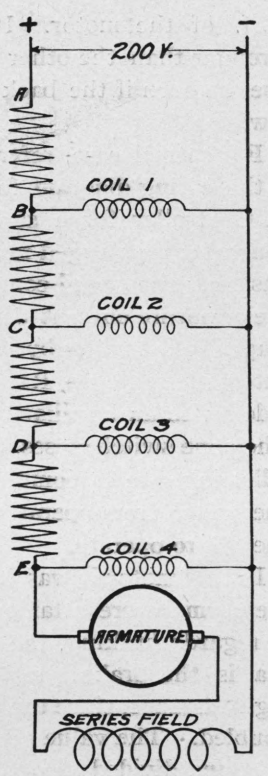


DIAGRAM 1921.



SKETCH #2



SKETCH #1

desired, then they will have a common contact, the controller being thrown to the "full on" position, and the individual operation of the switches being entirely automatic.

The braking of a motor presents two cases for solution, one of the series motor and the other the shunt or compound-wound motor. In this latter case the motor can be made to act as a generator by arranging the short-circuiting switch so that when reversal takes place, it puts in series with the armature a braking resistance of suitable amount and isolates that circuit from the supply line by preventing the first of the starting switches from closing. The field is maintained by the shunt winding. When the armature comes to rest the cessation of current causes the short-circuiting switch to open, the starting switches are no longer prevented from closing and being then energized through properly arranged contacts on the operating controller, the first one closes immediately, which furnishes current to the motor in the opposite direction to the flowing before reversal took place, and so causes the motor to rotate in the reverse direction.

In the case of the series motor the field must be furnished by the series coil through which the current must flow in the same direction as when operating as a motor, otherwise the field will not build up and there will be no generator action. Therefore, in the reversing mechanism this must be provided for, as well as a means for inserting the braking resistance.

A method of doing this, which is also applicable to shunt and compound motors, is to alter the short-circuiting switch slightly to form the "interlocking" switch. By means of a locking bar this switch prevents the starting switch from closing and adds a bank of resistance to the starting resistance, all of which is then used in braking, the line voltage being maintained on the circuit in addition to the e. m. f. generated by the motor.

For a shunt or compound motor this combined voltage is nearly double that of the line, therefore to keep the same load on the motor as the starting load, the resistance is doubled, which means that the resistance added by the interlocking switch is practically equal to the operating resistance.

However, with a series motor the speed may increase considerably on account of a weakened field, as would be the case if the load were diminished, and if reversal occurs at this increased speed, the back e. m. f. will be greater than the line voltage, making the combined voltage very high, 1,000 volts not being impossible with such a motor on a 220 volt circuit.

In such cases, then, the resistance inserted by the interlocking switch is proportioned to give the same current at the higher voltage.

The most economic condition would be to have the braking resistance so arranged that as the motor slows down and the voltage decreases, the same current could be maintained in the circuit by gradually cutting out the resistance. A method of doing this is represented in Fig. 4, in which the braking resistance is divided into three sections, R2, R3 and R4, by the switches S, S1 and S2, which are normally half closed. The coils of these switches are energized by the back e. m. f. of the motor, so that when the motor is operating the switches are open. When reversal occurs and the motor acts as a generator, the current is limited by the total resistance, but as the voltage decreases, S, S1 and S2 close successively, being constructed for different voltages, and the resistance is gradually diminished until the motor comes to rest, when only the starting resistance is in circuit.

In practice, however, this has not been used, the amount of resistance necessary for the maximum voltage being retained in the braking circuit until the motor is brought to rest.

The coil of the short-circuiting or interlocking switch may be energized in one of several ways. In Fig. 1 the coil of the short-circuiting switch, S, is so connected that when the motor operates as a generator, *s* is in series with it and the braking resistance, and being energized by the full current of the circuit, thus insures that the switch will open when that current is reduced to zero.

Fig. 2 represents a case where switch, S, is closed by a shunt coil, S20, which is energized from the supply circuit through a contact on the controller as the arm is being reversed. The current generated by the armature then flows through coil, S21, also operative on S. Before the arm of the controller reaches its extreme position the shunt coil is disconnected from the line and the switch is held close by S21 alone, which allows it to open when the current ceases.

Fig. 3 represents a case in which the shunt coil, S20, is used as in Fig. 2, but S21, instead of being in series with the braking resistance and motor, is in shunt around the series field and braking resistance.

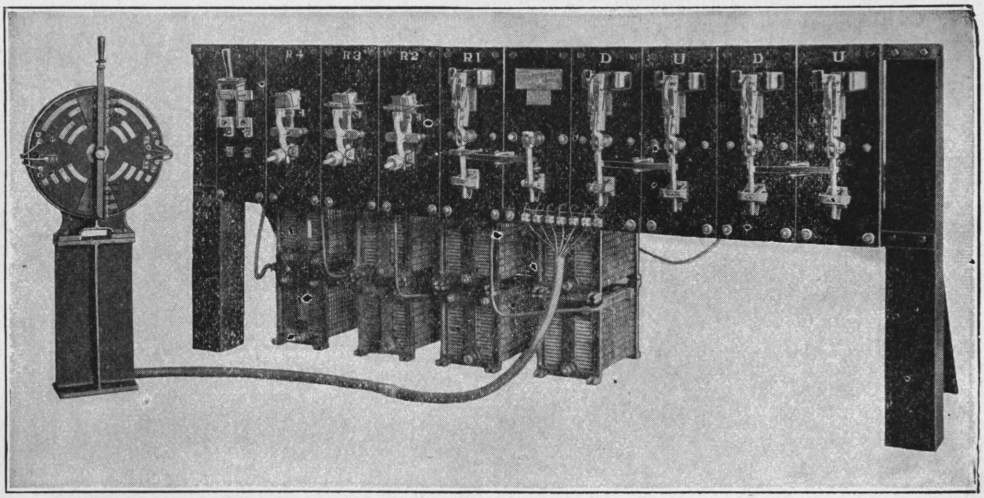
Another method of operating the switch, S, which is simpler, and is used in a controller to be described later, is to provide it with a single coil connected across the terminals of the armature, its action then being dependent on the back e. m. f. of the motor. It is made magnetically stronger than the other switches, so that it will operate even if the back e. m. f. of the motor be low.

For special case, refer to diagram 1921, which is the wiring diagram for a 100 h.p. 220 volt M. T. Controller for a series motor. The master controller is arranged for four running points and has only the speed-control free, the reversal of the armature current being accomplished on the magnetic controller by switches F, R, F, R. The automatic switches, R1, R2 and R3 are each provided with an auxiliary contact, through which, when one switch closes, the solenoid circuit of the following one is completed; this prevents any one switch from operating, should the preceding one fail to operate.

In this motor it was known that speeds above the normal were attained, so the case is treated, as regards braking, the same as a shunt motor; that is, the braking resistance is twice the starting resistance, since the voltage is approximately doubled. The value of the starting resistance is .48 ohm, divided into three sections of .16 ohm each, and that added by the S switch is also .48 ohm, making a total of .96 ohm. The resistance consists of cast iron grids, put up in a strong construction, which eliminates all wiring connections between them, and has superior advantages for dissipation of heat and for the expansion of the metal under the influence of the heat.

Consider the D. P. switch closed and the arm of the operating controller in the "forward" direction to the "full on" position. Current is supplied to the coils of F, F and R1, which switches immediately close and current flows from + line through R1, resistance f1, f2 and f3, series field from F2 to F1, switch F, armature from A1 to A2, and switch F to — line.

Taking the resistance of the armature and series winding at .055 ohms, which corresponds to 90% efficiency, the total resistance in circuit $=.055+.48=.535$ ohms, and the starting current $=\frac{220}{.355}=412$ amps. The automatic switches are set to operate at 175 volts, so that the drop through f1 when R2 operates=220—175=45 volts, or the current must decrease to $\frac{45}{.16}$=281 amps. With this current the volts applied to the resistance=281 x .535=150 volts, and when R2 closes, short-circuiting f1, the current will rise to $\frac{150}{.535-.16}$=400 amps. Similarly, when R3 closes, the current which has again decreased to 281 amps. will rise to $\frac{281 \times .375}{.375 - .16}$=490 amps., and when R4 closes it will increase to $\frac{281 \times .215}{.215 - .16}$= 1,100 amp., but on this last step the speed of the



motor is such that the heavy current exists only for an instant. The rushes of current could be made equal in amount by properly proportioning the resistance steps, but the latter are made equal in this case on account of the facility of arranging the grids.

As soon as the motor started, its back e.m.f. was impressed on the coil of switch S which however cannot close while R1 is closed on account of the locking bar between them.

If now, the arm of the controller is turned to the extreme "reverse" position the coils of F, F, R1, R2, R3, and R4 are de-energized in passing the "off position" so that these switches immediately open and S closes at once, and it prevents R1, and consequently R2, R3 and R4, from closing although its coil is energized. However, the coils of R and R are also supplied with current which closes those switches, establishing a closed circuit through the motor, series field and resistance f, f1, f2 and f3, and in such a way that the current flows through the field coil in the same direction, and the e.m.f. generated by the motor is added to that of the line in forcing current through the circuit. This voltage will be approximately 400V at the instant of reversal, so that the current $=\frac{400}{.48 + .535}=$ 394 amp. which decreases to $\frac{220}{.48 + .535}=$ 216.8 amps. as the motor comes to rest. Switch S then opens due to the cessation of current through its coil, allowing R1 to close; R and R being closed, the current rises to the value $\frac{220}{.535} =$ 412 amps. and continues to flow in the same direction through the field but from A2 to A1, through the armature, which is opposite to that first described, and the motor begins to rotate in the reverse direction. This cycle of operations is then repeated.

If a speed slower than full speed be desired one or more of the sections of resistance can be left in the circuit by carrying the arm of the controller far enough to energize only certain of the switches R1, R2, R3 and R4.

In case the voltage fails and the controller is left in the "full on" position, the controller takes care of the system when the circuit is re-established.

Thus it is seen that this type of controller safely handles the motor in all phases of its action, limiting absolutely the starting and braking currents to a pre-determined value. This also means a uniform demand on the supply system as well as permitting the maximum work of which the motor is capable to be obtained without danger of overload or sparking.

The operating controller is small and easy to operate, and is subject to no high voltages or heavy currents, while the magnetic switch controller requires no attention whatever from the operator.

In many cases of machine driving, systems have been supplanted by electricity, the advantages of which have been fully demonstrated and those same advantages as well as those above mentioned are obtained in the mill table driving or other similar service, since the M.T. Type controller has eliminated the difficulties which up to the present time have prevailed and barred the motor from this field of work.

Standard Methods in Detailing Structural Work.

By A. F. GORDON, '97.

THERE has been a great diversity among structural builders in regard to the shop methods and detailing of steel work, which may easily be seen in glancing over drawings of different firms in the past few years. While there are still differences in methods they are gradually coming down to standard forms which have been found to be more suitable both for shop work and erection.

In the present article the writer will take up mill buildings which offer the greatest variety of detailing and also the greatest amount of actual detail work. These are more simple in form than bridges and that class of work. The attempt will be made in a short article to give a few of the main points in hopes that they may be of use to any in this class of work.

In laying out the detailing, the first thing is to get the work in such shape that the material may be ordered as speedily as possible so that this may be rolled and shipped while the drawings are under way, and thereby save time. It is often possible to order the entire material before any detailing is done, but this can only be done with the more simple structures. There is a great variety of mill buildings for which steel makes a most economical and serviceable structure, such as rolling mills, open hearth furnace buildings, foundries, etc., and each has its peculiarities which must be observed in the carrying out of the design.

In roof trusses the Fink truss seems to find the most favor. In the older designs of trusses the tension members were either I-bars or loop rods, but now one seldom meets with them. Some engineers still specify such kinds of members. The usual practice now is to make all members of angles or in excessive spans, or where there are additional loads on the lower chords due to machinery, the lower chords are made up of channels. Complete details are not often given for roof trusses, that is, not all the rivets or members are located but merely indicated and left for the templet shop to lay out on the floor, the main dimensions, panel points and all field connections being given.

Trusses are riveted up complete in the shop as far as possible. Where splices occur in the lower chords, splice bars or plates must be used on the bottom to allow for the loss in section. Material should be ordered a little longer where there are splices to allow for milling or neat shearing and wherever possible cut members square and avoid skew cuts. The most general pitch for roofs is

¼ pitch, that is the rise is ¼ the span. Upper chords are composed of two angles back to back and where additional strength is required a plate is inserted between them throughout their entire length, giving more depth to the chord.

Purlins are made either from channels or angles, angles being used for bays up to 15 ft. and trussed angles for bays up to 20 ft. For longer bays channels are used. The trussed purlins are composed of the purlin angle proper with a ½″ rod or sometimes a light angle as the truss member and angles acting as the post member. Channel purlins should never be connected to rafter angles through their flanges, and in all cases connect purlins by lug angles riveted to rafter. Purlins are not required to be riveted but are bolted to connecting lugs. In line with this it might be stated that it costs on an average about ten cents to drive each field rivet, so where connections can be bolted the saving in cost is considerable. The great cost for field riveting comes from the necessity for the erection of scaffolding.

One-half inch dia. sag rods should be provided for purlins in bays 15 ft. or over to hold them more rigidly. The two purlins nearest the ridge are connected together and then separate rods connect between each pair of purlins down the roof clear to eave struts.

The general section of columns for this class of buildings is the plate and angle section composed of a web plate and two angles riveted back to back, forming the flanges. This is about the strongest section for the amount of metal used that can be made.

For very heavy loads, such as for heavy cranes as in open hearth furnace buildings, channel columns are used. Column bases are riveted to the column in all cases and as few rivets put in the bottom as are consistent with the size of column, as these have to be countersunk by hand on the bottom and mean extra expense.

The ends of columns resting on the base plate are milled to give a true bearing for the column, and the material should be ordered a little longer than actually required. The top of a column should also be milled where a cap plate is used.

The holes in base plates for anchor bolts should be about ¼ larger than anchor bolt to allow for slight adjustment in column in erection. A cheap and serviceable form for anchor bolts is to use one rod and bend it in the form of a U, forming a double bolt. This does away with anchor plates which are apt to get misplaced or lost.

The spacing of rivets in shaft angles to web plates should be about six inches, but should be closer for about three feet near the top and bottom of the column.

The bracing of a mill building by the system of rods is not often given the consideration it ought to have. Each separate building may require a different system of bracing and must be looked into individually. In general, though, all end bays should be securely braced with rods in the upper chords of the trusses, lower chords of the trusses and in the sides of the building between columns. In all cases where two sets of rods are required in any one plane, a strut must be provided between them, and in the case of trusses, these are most often composed of small I beams and it is more preferable to run the rods to points near the ends of the beams than to the trusses, so as not to cut out any material in the truss section. Pin connected rods are seldom used now as they are more expensive, but sometimes are specified where engineers are very particular that material shall not be cut away in web members. Ordinarily bevel washers are used and slots cut in webs of member to take them. They are made in pairs and one part slides on the other giving a bearing for the nut and allowing movement through quite an angle. Rafter rods are usually ¾″ dia. and ends upset to 1″ dia. for a distance of 4″. The lower chord rods are ⅞″ dia. upset to a 1¼″ dia. and side rods are 1″ dia. upset to 1⅜″ dia.

The most usual covering for mill buildings is corrugated iron or steel, the best grade for corrugated iron being the Rerolled Muck Bar Iron. The corrugations are approximately 2½″ wide and ¾″ deep. The gauge used for roofs is either No. 18 or No. 20 U. S. Gauge, and to be always specified as such. For sides of buildings either No. 20 or No. 22 gauge is used. The sheets are 30½″ wide before corrugating and allowing for laps will cover 24″ after corrugating. The end laps for roofing are six inches and for siding four inches. Sheets should be ordered in even foot lengths whenever possible as an extra amount is charged for cutting odd lengths. The spans for corrugated sheeting should not be over six feet for roofs and seven feet for sides although this is sometimes exceeded for the sides of buildings. The sheeting is fastened to the purlins by clips of hoop iron ¾″ wide, No. 18 gauge, and are about one foot long for angle purlins and about one and one-half feet for channel purlins. A clip is allowed for every linear foot of purlins or girts. The hoop iron is ordered in bundles of 100 lbs. which contain about 800 feet. The clips are fastened to the sheets and to each other by $\frac{3}{16}$″ x ⅜″ roofing rivets allowing 15 rivets per sheet.

A strut should always be provided at the eaves to take up the longitudinal stresses at the tops of the columns and heels of the trusses. This also supports the roof at the eaves. It is best to make this quite heavy, usually of two angles each for the top and bottom flanges, connected by lattice bars. This strut should not be over two feet deep. Side struts should be provided under windows, especially under continuous or lifting windows. Sometimes these struts are required to be quite deep to suit some requirements in the building and when they are over two feet deep, angles should be used for latticing instead of bars, for additional stiffness. Single angle girts are used to support the sheeting on the sides of buildings, and often sag rods are carried down from struts to support them the same as for the purlins.

Crane girders should be carefully designed and stiffened to take the load required for them. A shelf should be provided for them on the column and so designed as to take the entire load. The ends of the girders should be milled and connected to the web of the column and to each other. Sometimes a knee brace is used from the bottom of the girder to the column, though this is not allowed by all engineers as the brace may come a little long, in which case the bearing on the column may be affected and the knee brace take the entire load. The rails are connected to the girder by cast iron clips in some cases, and in others by hook bolts hooking over the flange of the girder and passing through the web of the rails.

There are a number of different styles of windows used in the ordinary mill building varying in adaptation to different classes of buildings. A few will be mentioned and their method of erection given. The most common are continuous sliding, continuous fixed, continuous windows on trunnions, both vertical and horizontal, continuous balanced, both two and three sashes high, and the corresponding single frames for the above.

The sashes come in two thicknesses, 1⅜″ and 1⅞″ thick and the frame of the sash usually 2¾″ deep, ¼″ being allowed for muntins. The number of lights, quality and size of glass to be used should always be specified on the design. In frames with movable sash ¼″ should always be allowed for clearance. The top and bottom sills of the window frame are 1¾″ thick.

Angle girts are to be provided with holes in the outstanding leg spaced about three feet to which nailing strips are bolted by ⅝″ diameter bolts, the heads of the bolts being countersunk in the wood. These strips are 3″x1½″ for the top and 3″x2½″ for the bottom of the windows. The window frames are then nailed to these strips.

The frames are shipped to the site of the building knocked down and should be ordered in the following way: the total number of sashes, giving number of pairs, height, width, thickness, total number of lights, size and quality of glass, number of different frames for the sashes, giving length out to out of end posts, complete with nailing strips, as per the sketch sheet which should accompany the order.

The balanced lifting windows are provided with $\frac{3}{16}$″ wire rope attached to the top of the sashes, passing over a small pulley in the top of the frame. The sashes are supposed to counterbalance each other and as one is raised the other is lowered making a cheap and servicable counter-balanced sash. Then there are the ordinary weight counter-balanced sashes more commonly used in brick walls.

The estimation of the quantities of paint required on steel work is apparently rather difficult to arrive at, but is not so hard as it seems. A very simple method is as follows: Count one gallon of oxide of iron paint as covering 400 square feet, one gallon of red or white lead 350 square feet, one gallon of asphaltum paint 300 square feet, and one gallon of graphite paint 800 square feet. To find the amount of paint required take the estimated weight of the building or structure, say 450,000 lbs. of frame work and 30,000 square feet of corrugated steel. Assume the average thickness of the metal which will probably be $\frac{1}{4}''$ or $\frac{5}{16}''$ for ordinary mill buildings, take the weight of a square foot of this which for $\frac{5}{16}''$ thick will weigh 12.75 lbs. per square foot, divide the total weight of the building by this amount which will give the number of square feet of surface to be painted twice (both sides), in this case it will give approximately 35,300 square feet. Taking twice this gives 70,600 square feet. To this add the actual number of square feet of corrugated steel surface plus 10% for corrugation which would be 33,000 square feet one side or 66,000 square feet both sides. Total number of square feet to be painted 136,600. Divide this by the number of square feet one gallon of the kind of paint to be used will cover, in this case for black graphite 800 square feet, which will give approximately 171 gallons.

Alumni Association.

NOT so very long ago the Alumni Association of Rose in Annual Convention gave some consideration to a movement towards an increase of the endowment fund, consuming sufficient time for the appointment of a Ways and Means Committee of three. Thus was the crusade inaugurated, and all that remained to complete the work was for the Committee to step out into the highways and by-ways and pick up the money. This they proceeded to do.

The first attack was made in broad day-light by means of a circular letter to the Alumni setting forth briefly the beneficience of the illustrious founder, the excellent work and high rank of the Institute and the pressing need for a larger annual income to maintain the enviable position it had already achieved; closing with an appeal to the hearts of the men who had so profited by the generosity of Chauncey Rose.

Some months later a second letter and then a third, each enclosing a pledge blank, brought substantial returns. The total amount subscribed was ten thousand eight hundred dollars, and toward the close of last year more than two thousand dollars had been paid in to the treasurer.

Many months had rolled around since the Ways and Means Committee had been in direct communication with the boys whom Rose had educated, and it was past the middle of December when the following letter was hurriedly dispatched to those who had not answered previous letters, and with it a pledge blank and stamped and addressed envelope to insure prompt and proper return:

Indianapolis 12/20/04

Dear Poly—

Won't you please sign the enclosed slip and send it back in the stamped envelope by next mail so it will be sure to get in Rose's stocking Saturday night?

Now don't forget! You would not be one to disappoint the little girl, I know. She has been awfully good to us and we owe it to her

I've sent mine. Date yours 1905 if you like but don't forget to sign it!

A Merry Christmas to all the folk from

Your brother

Ed

Two hundred and seventy-one letters went out, and scarcely more than twenty of the stamped envelopes came back. Of these, twelve brought subscriptions of ten hundred and sixty-one dollars, making the total amount pledged to date, $11,861.00. It is a significant fact that of these last subscriptions one was from the class of '91, one from '94 and the remainder divided between the two last classes graduated. Are we to understand from this that increase of business cares and a little element of time make us forgetful of the debt we as individuals owe to our beloved alma mater? We are proud of Rose—we would instantly resent any suggestion that a better, a more thorough or successful school existed, and yet some of us are slow to finance our loyalty. At the present time there have been exactly twenty classes graduated, from that of '85, with three men, to the last of 1904 with thirty-one. The total number of living alumni is three hundred and sixty-five, and of these ninty-four have subscribed to the Alumni Fund—a matter of over 25 per cent. The average amount pledged is $126.00, or almost $33.00 for every man who holds a sheepskin with the likeness of Chauncey Rose. Indeed, this is a record of which we may well be proud and it is a source of much gratification to the Board of Managers and Faculty whose labors in our behalf have been crowned with so great success. Why can we not make the subscribers 100 per cent. of the whole instead of 25 per cent? There is one living alumnus for each day in the year. Three months of them are with us. Why, my brother, do you stand with the silent nine?

The pledge of one of the most recent graduates offers a splendid suggestion. It reads:

1905	$1.00
1906	2.00
1907	4.00
1908	8.00
1909 to 1914 inclusive	16.00
Total	$111.00

and he forwarded the first dollar with the pledge.

Wouldn't it be a glorious thing to have some sort of a subscription from every man? And is there one who could not afford one dollar a year for the next ten years? Of course not—and that would add $2,710.00 to our growing fund.

If you cannot find one of the little blanks write to the Technic or to E. F. Folsom at Indianapolis, and one will be sent by return mail. By all means, subscribe, and do it now!

The following schedule exhibits by classes the total subscriptions made and the averages:

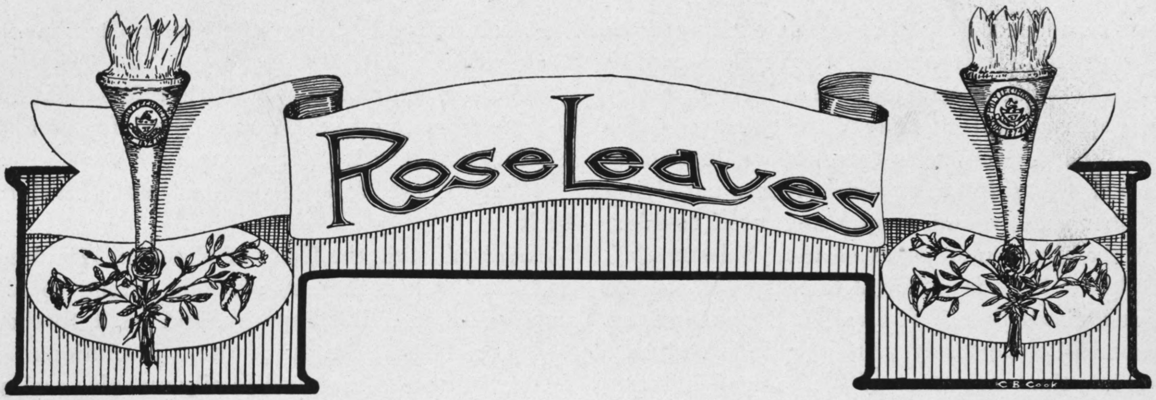
Class.	Members Living.	Subscribed.	Amount.	Average per Member.
'85	3	2	$ 450	$150
'86	14	2	200	15
'87	8	2	200	25
'88	10	3	400	40
'89	9	4	700	77
'90	14	2	200	15
'91	17	3	400	23
'92	24	10	1,100	46
'93	20	6	850	43
'94	17	5	700	41
'95	19	4	950	50
'96	25	4	700	28
'97	24	5	500	21
'98	23	5	950	41
'99	21	6	550	26
'00	15	5	600	40
'01	17	4	350	21
'02	17	7	700	41
'03	37	9	850	23
'04	31	6	511	17
	365	94	$11,861	

ALUMNI NOTES.

O. E. McMeans, '96, recently with the Nordkye & Marmon Co. of Indianapolis, has associated himself with Chas. A. Tripp, as a firm of mechanical and electrical engineers, Indianapolis.

Robert A. Philip, Class of 1897, visited the Institute recently. He was on his way to Boston, where he will be with the Stone & Webster Co., having been transferred by that company to Boston from Tacoma, Washington. His address is 84 State street, Boston. Care Stone & Webster.

Fred A. Fishback, Class '02 has gone with the Electric Controller and Supply Company, at Cleveland, Ohio. The following men from Rose are now with this company. Arthur C. Eastwood, '98, Gen. Manager and Engineer; Jay H. Hall, '97; Harry S. Richardson, '00; Brent Wiley, '98; Claiborne Pirtle, '98; Brent C. Jacob, '03; Frederick C. Fishback, '02.



Wood Pulp—The Soda Process.

By LEON J. WILLIEN, '06.

THERE are three classes of wood pulp, (1) mechanical or ground wood, (2) soda process wood, and (3) sulphite wood pulp.

The wood which is most commonly used in the manufacture of soda pulp, is spruce. The logs are hewn in the forest, roughly barked, and shipped to the mill, where the first operation is to cut them up by steam saws into blocks about three feet long. Any bark that may still cling to the log is removed by a rapidly revolving corrugated wheel of steel, the blocks are then thrown into a chipping machine with great wheels, whose short, slanting knives quickly cut the blocks into small chips, which are then made to pass through a revolving wire screen; the chips that are small enough to go through the screen are taken up into the hopper part of the building, which contains large upright boilers, or digesters, while the chips that do not go through the screen are carried back into the chipping machine.

From the hoppers the chips are thrown into the digesters, which are charged with a strong solution of caustic soda, and are boiled under a steam pressure of 100 pounds.

The "cooking," or boiling that the wood is subjected to, requires from 8 to 12 hours, and effects a complete separation of all resinous and foreign substances from the fine and true cell tissue, or cellulose, which is left a pure fiber. In the case of all fibers, whether rag or wood, the painstaking work counts, and the excellence of the paper is largely dependent upon the time and care given to the reduction of the pulp from the original raw material.

After the chips have been boiled long enough, the pressure is reduced to 40 pounds, and they are blown out into a blow pit, where, by striking against a target, they are blown up into a fibrous or pulp form.

The pulp is emptied from the blow pit into washing tanks, where it is thoroughly washed. These tanks have perforated pipes in the bottom, by means of which the black liquor that contains all the foreign substances, is pumped off and run through a reclaiming process, where from 75% to 85% of the soda is reclaimed.

When washed the pulp is carried into tanks, from where it is passed between rollers, which leave it in thick, damp sheets, that are folded up evenly for shipment, or for storage for future use. If a paper-mill is operated in connection with the pulp-mill, the pulp is not necessarily rolled out into sheets, but is pumped directly from the tanks to the heaters.

The chemical wood pulp of the best quality makes an excellent product, and is largely used for wrapping paper; and is sometimes used for both print and book paper; it is frequently mixed with rag pulp, making a paper that can scarcely be distinguished from that made entirely from fine rags, though it is not of the proper firmness for the best flat or writing papers. All ordinary newspaper, as well as some of the cheaper grades of book and wrapping paper, are made entirely of wood, the sulphite or soda process supplying the fiber and ground wood being used as filler. In the average newspaper of today's issue 25% of sulphite fiber is sufficient to carry 75% of the ground wood filler. The value of the idea is an economical one entirely, as the ground wood used costs less than any other of the component parts of a print-paper sheet.

RESOLUTIONS OF THE COUNCIL.

Whereas, We have been deprived by death of our fellow student, Tracy Morrow, be it

Resolved, That we, the Student Body and Student Council of the Rose Polytechnic Institute, express our sorrow and sympathy to the bereaved family; and be it

Resolved, That these resolutions be spread upon the records of the council, and that a copy be sent to the family and that a copy be sent to The Rose Technic for publication.

BENSON,
PFEIF,
Committee.

RESOLUTIONS BY ORCHESTRA.

Whereas, It hath been the pleasure of Almighty God that Tracy Richard Morrow should be called from membership among us; and

Whereas, The Orchestra feels itself deprived of a most faithful and enthusiastic member; be it

Resolved, That we thus express our most heartfelt sorrow and sincere sympathy to the bereaved family. Be it further

Resolved, That a copy of these resolutions be forwarded to the family of our friend, and also that a copy be sent to The Rose Technic for publication.

ARTHUR W. WORTHINGTON,
EDWARD C. RYAN,
ADDISON W. LEE,
Committee.

Resolutions adopted by the Junior Class upon the death of T. R. Morrow.

Whereas, Our Heavenly Father has seen fit to take from our midst our beloved friend and classmate, Tracy R. Morrow and

Whereas, we feel deeply his loss, therefore be it

Resolved, that the Class of Nineteen Hundred and Six through these resolutions extend to his family its heartfelt sympathy, and be it further

Resolved, that a copy of these resolutions be forwarded to the bereaved family and also a copy be given to the Rose Technic, and to each of the Terre Haute papers for publication.

ROGERS,
RYAN,
KAHLERT,
Committee.

OBITUARY.

Tracy Richard Morrow was born in Terre Haute, April 19, 1885. He received his early education in the public schools of this city, attending there until his parents removed to Indianapolis. Here he attended the grammar school and then the Manual Training School. After attending the latter for three years, his parents came back to Terre Haute, and he entered the Freshman Class of Rose Polytechnic, passing the entrance examinations.

During his course at Rose he studied civil engineering. His work was very good, and he stood high in his class. He was an enthusiastic member of the Orchestra, being a cello player of considerable ability.

For several months previous to his death his health had not been of the best, but as long as he was able, he carried on his studies, ever hoping to be able to regain his health and keep on with his class. He contracted pneumonia, however, and died on January 11th, at the age of nineteen years and eight months.

TELEGRAPH COMPANY.

Owing to several unavoidable accidents, the South end of the telegraph line has not been working with entire satisfaction. However, the North end of the line has been in good working order since September, and we have had no trouble so far, caused by members leaving their keys open. There are at present fourteen instruments on the North end, and all are in working order. By the 20th of this month we hope to have the entire line working again, so that the operator at the South terminal may send "good morning" to the operator at the North terminal, on a line not less than 4 miles in length.

H. J. W.

The Glee and Mandolin Clubs gave a concert at the Maple avenue M. E. Church on the evening of January 20th, which was well attended in spite of muddy streets and few street cars. The selections of the Mandolin Club were very well rendered and liberally applauded. Harry Shickel earned glory by recounting the misfortunes of Belinda in his most sympathetic manner; "Watermillion" and other songs brought forward stars too numerous to mention. The concert was brought to a close with "For Old Rose," by the Glee Club, followed by the yell.

The program was as follows:

1. a Frost King (March) . . . . Kenneth
   b The Message of the Violet . . . . Luders
   c Little Kickapoo . . . . Von Tilzer

MANDOLIN CLUB

2. a We Meet Again Tonight.
   b Dat Watermillion.
   c Massa's in de Cold, Cold Ground.
   d Belinda.

ROSE GLEE CLUB

3. a Overture, Northern Lights . . . . Weidt
   b Tell Me That Beautiful Story . . . . Von Tilzer

MANDOLIN CLUB

4. a A Soldier's Farewell.
   b Spare the Old Homestead.

GLEE CLUB

5. a Queen Roses, (Waltz) . . . . Weidt
   b Picaninnies a Plenty . . . . Jocko

MANDOLIN CLUB

6. a The Raggedy Man.
   b For Old Rose.

GLEE CLUB

Director Glee Club . . . . . . MRS. ALLYN G. ADAMS
Director Mandolin Club . . . MR. WILL BRANDENBURG

ROSE, 35; DE PAUW, 24.

The rooters surely missed their chance when they failed to send a large crowd to Greencastle, Jan. 21—for the spectators and players both agree in saying that this was one of the fiercest games they had ever seen.

The officiating of Mr. Jamison, of the local Y. M. C. A., for Rose, and Mr. McGee, of the Indianapolis Y. M. C. A., gave the greatest satisfaction to both teams, and neither captain had "a kick coming" when the game was over.

The crowd was so large that the seating capacity in the balcony was not sufficient, and people were lined along the wall just outside of the foul lines. In nine colleges out of ten this crowd would have been on the floor about half the time, especially in such a close game.

But the true sportsman spirit was in this crowd better than it has ever been here at Rose, for not only did they maintain quiet when Thurman tried for foul goals, but they applauded every good play our team made.

Perhaps the most disappointed man on the DePauw team was Capt. Holmes, the "five goals a game" man. He ran up against a new proposition in Johnny, and about the only time he got his hands on the ball was when he tried for foul goals.

Trueblood, as usual, was the life of the Poly team, and though he did not try especially for field goals, his passing and floor playing were features of the game, and caused many wondering comments from the crowd. Lindeman and Daily put up a good game, though Daily was still rather weak from his sickness and had a man against him inclined to rough it a great deal.

But the man who shone that night was Thurman. It seemed as if every time he threw the ball at the basket it went in. Sideways, backwards, overhanded — every way; in fact, he would just throw the ball and it would do the rest. When the game was over, he had to his credit 21 of the 35 points.

DePauw started the game with a rush. Fairfield batted the ball to Scoby, Dorste passed back to him, and he dropped the ball in. Again the ball was tossed up at center—the same criss-cross was worked and DePauw got another field goal. Then Thurman got a field goal, but on the next toss-up DePauw got another goal after only three passes. And they meant business, for before Rose had time to wake up the score was 13–8 in DePauw's favor. Then, slowly but surely, we began to run them off their feet, and when the half ended the score was DePauw 17, Rose 15.

The second half was a walk-over, and hardly a fumble was made. There was only one field goal for DePauw, while we secured nine, and the score this half, 20–7, tells the tale as well as anything.

Final score—Rose, 35; DePauw, 24.

DE PAUW.

	FIRST HALF.			SECOND HALF.		
	Field Goals.	Foul Goals.	Fouls.	Field Goals.	Foul Goals.	Fouls.
Holmes, F, ...	0	5	0	0	5	2
Scoby, F., ...	1	0	4	0	0	1
Fairfield, C., ...	2	0	0	1	0	3
Dorste, G., ...	1	0	4	0	0	1
McKee, G., ...	2	0	3	0	0	1
Total, ...	6	5	11	1	5	8

ROSE.

	FIRST HALF. Field Goals.	Foul Goals.	Fouls.	SECOND HALF. Field Goals.	Foul Goals.	Fouls.
Thurman, F.,...	3	5	2	5	0	2
Daily, F , ...	1	0	1	1	0	1
Trueblood, C.,..	0	0	1	1	2	1
Johnson, G.,....	0	0	3	0	0	3
Lindeman, G.,..	0	0	2	2	0	1
Total, ...	4	5	9	9	2	8

Rose awarded 2 points by referee.
Score—Rose, 35 : DePauw, 24.
Fouls—Rose, 17 ; DePauw, 19.
Referee—Jamison, T. H. Y. M. C. A.
Umpire—McGee, Indianapolis Y. M. C. A.
Timers—Dewey and Wischmeyer.
Scorers—Sheets and Lee.

WABASH, 37; ROSE, 28.

THE first defeat, and the old hoodoo of Friday, the thirteenth, still holds good But hardly anything else was expected when it was learned that Daily was out of the game on account of sickness. His place was filled by Lindeman, and Glover took Lindeman's place at guard.

Wabash played her usual rough game, and seemed in every case to prefer fouling a man who was trying for goal, and allowing a chance at foul goal rather than the chance at the field goal. However, with all this, and in addition, with the fact that the referee was not all times on the alert to Wabash fouls, the game was a good-natured one and enjoyed by everybody.

For Wabash, Lehmann and Wickes were the stars, Wickes making one especially brilliant goal from almost the middle of the floor. For Rose every man played for all he was worth, Thurman probably doing the best work. In the first half he threw 13 foul goals out of 15 chances, while in the second half he threw 7 out of 14—making in all 20 goals out of 29 chances. Compare this with Lehmann's 12 out 24, and then remember that last year Lehmann was one of the best in the State in this line.

All through the game Wabash led, although Rose approached within three points at one time in the second half. The summary is given below:

WABASH.

	FIRST HALF. Field Goals.	Foul Goals.	Fouls.	SECOND HALF. Field Goals.	Foul Goals.	Fouls.
Walters, F.,....	1	0	4	0	0	3
Lehmann, F.,.	2	7	1	0	5	1
Sprow, C., ...	4	0	6	1	0	3
Wickes, G.,....	1	0	1	2	0	3
Williams, G., ..	0	0	3	0	0	4
Total, ...	8	7	15	3	5	14

Note:—Wabash allowed 3 points by referee.

ROSE.

	FIRST HALF. Field Goals.	Foul Goals.	Fouls.	SECOND HALF. Field Goals.	Foul Goals.	Fouls.
Lindeman, F....	1	0	1	0	0	1
Trueblood, C....	1	0	3	0	0	2
Thurman,F.	0	13	0	1	7	0
Glover, G.......	0	0	4	0	0	4
Johnson, G.	0	0	5	0	0	4
Freudenreich ...	0	0	0	0	0	0
Total, ...	2	13	13	1	7	11

Rose allowed 2 points by referee.
Score—Wabash, 37 ; Rose, 28.
Fouls—Wabash, 29 ; Rose, 24.
Referee—Shepard, of Crawfordsville.
Umpire—Jamison, of T. H. Y. M. C. A.
Timers—Daily, Diddle.
Scorers—Ristine, Lee.

ROSE, 23; NORMAL, 8.

Although the score would point to a slow, lifeless game, it was certainly exciting—at least from a Poly's point of view. Our work was superior to that of the Normals, but the ball was too slippery for swift passing, so instead of playing around the Normals, we played around ourselves.

The game started out with a ten minutes' exhibition of passing by both teams, then Thurman broke the spell with a goal from foul. Daily followed soon with a field goal, and the Normal scored their first point on a foul goal by Trible. A field goal by Lindeman and one by Daily followed, then Thurman threw two. The Normal's first field goal came just before the end of the half, Cummins making the throw. Score—Rose, 12 ; Normal, 5.

The second half was a repetition of the first, except the Normals did not make their field goal. Daily got two more, Lindeman one, and Thurman one, besides two goals from fouls. Johnson, as usual, outplayed his man and prevented him from even getting a fair shot at goal. Outside of the fumbling the team played a fair game, although they failed to show the usual snap and spirit.

INDIANA STATE NORMAL.

	FIRST HALF.			SECOND HALF.		
	Field Goals.	Foul Goals.	Fouls.	Field Goals.	Foul Goals.	Fouls.
Trible, F., ...	0	2	1	0	0	2
Montgomery, F.,	0	0	2	0	3	4
Westhafer, C., ..	0	0	2	0	0	0
Cummins, G., ..	1	0	0	0	0	0
Metzinger, G., ..	0	0	2	0	0	1
Total.......	1	2	7	0	3	7

Normal allowed 1 point by referee.

ROSE.

	FIRST HALF.			SECOND HALF.		
	Field Goals.	Foul Goals.	Fouls.	Field Goals.	Foul Goals.	Fouls.
Thurman, F., ...	2	2	0	1	2	0
Daily, F., ...	2	0	0	2	0	0
Trueblood, C., ..	0	0	2	0	0	3
Johnson, G., ...	0	0	2	0	0	1
Lindeman, G., ..	1	0	2	1	0	0
Total, ..	5	2	6	4	2	4

Rose awarded 1 point by referee.
Score—Rose, 23 ; Normal, 8.
Fouls—Rose, 10 ; Normal, 14.
Referee—Morgan, I. S. N.
Umpire—Jamison, Y. M. C. A.
Timer—Wischmeyer.
Scorer—Lee.

ROSE, 33 ; Y. M. C. A., 23.

On Saturday night, January 28, Rose accomplished what has been her highest ambition for the last three years, by defeating the local Y. M. C. A. 33 to 23, and yet the team and rooters seemed to be more discouraged than elated, after the game. For while the Y. M. C. A. had three of her regular last year's team in, they were really not in our class, and the score should have been much higher.

The crowd, for the most part, took the game as a joke, and as the officiating of Mr. Jamison and Mr. Kisner was very good, everybody stayed in a good humor and enjoyed it thoroughly.

Trueblood played unusally well against Connors, allowing him only two of his "luck" goals. Daily also "starred," throwing seven field goals, some of them very difficult chances.

Johnson was out of the game with a sore ankle, and Glover filled his position in good style, not allowing his man a goal. Lindeman's man threw one field goal, but Lindeman evened things up by throwing two himself.

At no time during the game was the outcome in doubt, and this certainty of winning was doubtless the reason our team did not put forth its best efforts.

At the end of tne first half the score stood 23–14 in favor of Rose, and the final score was Rose 33, Y. M. C. A. 23.

Y. M. C. A.

	FIRST HALF.			SECOND HALF.		
	Field Goals.	Foul Goals.	Fouls.	Field Goals.	Foul Goals.	Fouls.
Bogeman, F., ...	0	0	0	0	0	0
Brown, F., ...	0	0	1	1	0	1
Connors, C., ...	1	4	1	1	2	1
Paddock, G., ...	2	0	2	0	0	1
Bothwell, G., ...	1	0	5	1	0	1
Reisinger, F., ...	0	0	0	0	0	0
Total, ...	4	4	9	3	2	4

Y. M. C. A. awarded 3 points.

ROSE.

	FIRST HALF.			SECOND HALF.		
Daily, F., ...	6	0	3	1	0	0
Thurman, F., ...	1	0	5	2	2	2
Trueblood, C., ..	0	5	1	0	0	0
Lindeman, G., ..	1	0	1	1	0	3
Glover, G., ...	0	0	0	0	0	0
Total, ...	16	5	10	4	2	5

Rose was awarded 2 points,
Score—Rose, 33 : Y. M. C. A., 23.
Fouls—Rose, 15 ; Y. M. C. A., 13.
Referee—Jamison, Y. M. C. A.
Umpire—Kisner, Terre Haute.
Timer—Wischmeyer.
Scorers—Kadel and Lee.

ROSE, 39 ; INDIANA, 28.

There were many speculations as to what the outcome of the Indiana-Rose game would be, especially when, the night before, Indiana was defeated by the Normals 27 to 24. And when the first half was over the game seemed more in doubt than ever to some, but not to any who really knew the team, for in every game this year they have outplayed their opponents in the second half.

The first half was barely started when Johnson had a foul called for holding, and Taber converted it into a point. After about three minutes Lindeman threw the first field goal. Others followed in quick succession until the score stood 9–3 in favor of Rose, Taber having secured Indiana's field goal. After this Indiana took a brace, and when the half ended the score stood Rose 15, Indiana 13.

In the second half all that Indiana could see for about ten minutes were streaks of red and white, and when they did get hold of the ball, they seemed to afraid to let go of it. However, they finally became desperate, and managed by the hardest playing they had done to bring their score up to within a respectable distance.

For Indiana Carr and Harmeson were the ones who did by far the best work. For Rose, Daily was easily the star, with eight goals to his credit, and these in spite of the fact that Taber, Indiana's captain, was his guard. Johnson surprised everybody, himself included, by throwing two field goals, both difficult shots.

Score and summary :

INDIANA.

	FIRST HALF.			SECOND HALF.		
	Field Goal.	Foul Goals.	Fouls.	Field Goals.	Foul Goals.	Fouls.
Ritterskamp, F.,	0	0	2	2	0	2
Harmeson, F.,..	2	0	1	0	1	2
Teeter, C.,......	1	0	1	1	0	0
Taber (Capt.), G.,	1	2	1	1	1	2
Carr, G.,.......	1	0	1	2	0	0
Total,......	5	2	6	6	2	6

Indiana was awarded two points.

ROSE.

	FIRST HALF.			SECOND HALF.		
	Field Goals.	Foul Goals.	Fouls.	Field Goals.	Foul Goals.	Fouls
Thurman, F., ..	1	4	0	1	5	0
Daily, F., ...	2	0	0	6	0	3
Trueblood, C., .	0	0	1	0	0	2
Lindeman, G., .	1	0	0	1	0	1
Johnson, G.,....	1	0	1	1	0	2
Total,.........	5	4	2	9	5	8

Rose awarded 2 points.

Score—Rose, 39 ; Indiana, 28.

Fouls—Rose, 10 ; Indiana, 12.

Referee—Hains, of Wabash.

Umpire—Jamison, T. H. Y. M. C. A.

Date—Feb. 4, 1905.

NOTES.

We are very much indebted to Mr. Harry H. Schwartz, '01, for a letter received, correcting an error in the Rose track records, as published in last month's TECHNIC.

The record for the hammer-throw should go to Darst, '95, who threw the 16-pound hammer 109 ft. 5½ in., on May 24, 1895.

The best record made by Peker, while attending Rose, was when, in 1900, he put the shot 38 ft.

Another correction is that of the time in the 220-yd. dash, which is held by Turk at $22\frac{4}{5}''$ instead of 22 flat.

The basket-ball men could not say too much in praise of the crowd at the DePauw game, and all agree in saying they received the best treatment they ever received on a basket-ball trip. We are certainly glad to see that the reform movement seems to have hit DePauw.

There were 2,100 paid admissions to the recent Purdue-Earlham basket-ball game. Verily, "Some people are born lucky."

Base-ball practice is now under way, and a few words should be said about indoor practice. It is the intention of the management to practice the candidates under a regular schedule. This schedule will include (for each man) practice in the morning about three times a week and twice in the afternoons, including Saturday afternoon. Saturday will be given over to bunting, batting, grounders, instructions in signals, etc.

Anyone intending to try for the team must get this indoor practice, and get it regularly. This particularly applies to Freshmen. There will be a number of positions open, and this training will be absolutely necessary to win a place.

It was noticeable that the five men leading the batting list last year were among the most faithful workers in the batting cage.

Logan—"Sit up there, Wickersham; you are the laziest boy in the shop."

Wickersham—"I can't help that, it is in the blood."

Sam Garvin—"I will have to buy a new shaving brush; my old one is about worn out."

Wischie—"What! Have you been shaving the brush?"

Bennett (in library recitation room, as the lathe starts up in Jo-Jo's den)—"I wonder what that racket is?"

Byrn—"I think it's Jo-Jo doing an exhibition half."

Hiram Cannon writes home that the hard pavements hurt his feet, and that the street cars keep him awake at night.

Plew—"Professor, when you were at college in Germany, did you take notes in German?"

Prof. Wickersham—"Yes, but I never could read them."

THE ATHLETIC COLLEGIAN.

He knows his foot-ball through and through;
His other books he skims.
He cuts the higher branches to
Improve the lower limbs. [—*Ex.*

Johnson, Cash, Berrien and Mitchel have joined the Sigma Nu.

OBEDIENT.

Prof. Wicky—"That's a fine looking boy."

Prof. McCormick—"Yes, and I can make him do anything he wants to."

WHICH?

Major Kiefer—"Say, Mac, are juleps better than cock-tails, or cock-tails better than juleps?"

Colonel McBride—"Both."

Struck, Budge and Whitehead have been initiated in the A. T. O.

Prof. Hathaway (giving out the Sophomore examination papers)—"Boys, you had better not try to cheat, for I am not as easy as I look."

Bland (in the barber shop)—"If you cut me I will only give you five cents."

Barber—That would be a cut in prices."

George D. Jones arrived in Terre Haute on Jan. 20th, from his home in Honolulu, T. H., intending to take up preparatory work and to enter Rose with the class of '09. He will take the electrical course.

Fischer, '08, has become quite convinced that if Doc was on one end of an Atwood's machine cord and he on the other, that his upward velocity would be considerable.

Elmer W. Heisel, '08, left for his home in Portsmouth, Ohio, on the 18th of January. He had been seriously ill with pneumonia before coming to Rose, and a spell of sickness during the cold weather made it advisable that he drop his studies for a time. He expects to go West to recuperate, and to return to Rose next summer.

Freshman Algebra—"If Mac equals y and the class equals x, what is the differential coefficient of x with respect to y when Mac sees five points on the board and the class sees only three?"

Glover—"Professor, where is the governor on a locomotive?"

Prof. Wagner—"He sits in the cab."

Fair Normalite (at the Poly-Y. M. C. A. game)—"Oh my! Did you hear Mr. Thurman say that he would slap that man?"

Junior—"What is the invisible gas that is seen after a boiler explosion?"

Worthy (after the exams) —"I am going to do some tall sleeping now, to make up for lost time."

(Worthy is six feet three.)

Ryan—"We shouldn't have got twice as much as we ought."

BY THE FACULTY.

"Very soon later these conditions are reversed."

"Not exactly so, but in the neighborhood of being approximately roughly so."

"Jacky" (lecturing on Gear Teeth)—"Now, after getting my teeth spaced on the gear, I lay them out on the rack."

Wicky (politely, to his I. C. S. French graphophone)—"Just a moment, please; I did not catch the last sentence."

"ER IST DEUTSCH."

Goodman—"How do you pronounce the difference between an umlauted 'u' and 'i'?"

Exchanges.

Yale has a basket-ball schedule of thirty-nine games.

Twenty-two men have been trying for the team at Leland Stanford.

The Rensselaer Polytechnic Institute has received a total of $447,266 in the form of gifts during the past thirty years.

Rose, Michigan's champion shot putter will be barred from all college athletic events hereafter.—Case Tech.

The Pennsylvania System has just let the contracts for two water softening plants, one of which is to be erected at Richmond, Indiana, and the other near Bradford Ohio. These two stations will furnish enough water for all the trains in both directions, thus eliminating the boiler scale to some extent.

The Agriculture College of Utah has a band of thirty-five pieces.

The January Polytechnic contains an extensive article on concrete and concrete steel in the United States.

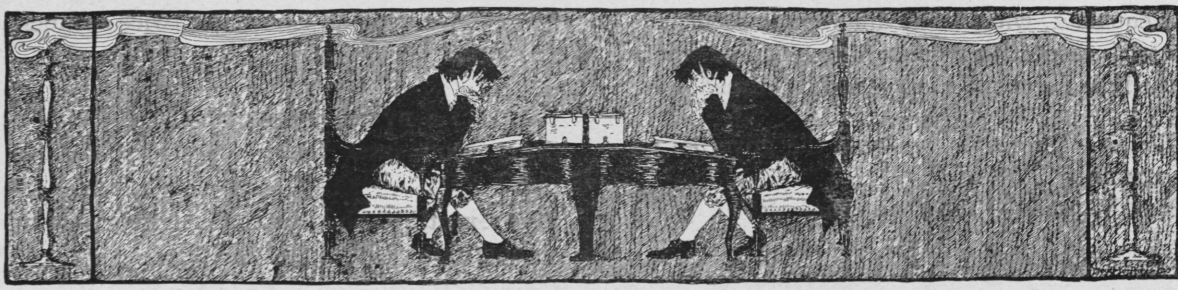
A chapter of Sigma Xi is soon to be established at Case. The society is an honorary one and is to encourage original investigation in science, pure and applied. It occupies a place in scientific institutions that Phi Beta Kappa does in literary schools.

Over five million dollars will be spent on the new Carnegie Technical Schools at Pittsburg.

Dr. Francis G. Barnes, the new president of Illinois Wesleyan, will take his chair July 1st.

Purdue has received $15,000 from the Big Four for the monument to be erected to her dead foot-ball men. The Seniors have also started their subscription for the same and when $50,000 has been raised the Faculty will double it.

Dr. W. L. Bryan of Indiana University gave the address of the day on Founders' Day at De-Pauw.



REVIEWS

THE Proceedings of the American Institute of Electrical Engineers, for January, contains two papers entitled Acyclic (Homopolar) Dynamos, and "Modern Central Station Design," which were presented before the Institute at the meeting on January 27. Also the discussions of the paper on "Problems of Heavy Electric Traction" which was presented at a previous meeting.

The Proceedings of the American Society of Civil Engineers for the month of December contains two papers which are entitled "Methods of Location on the Choctaw, Oklahoma and Gulf Railroad" and "Maximum Rates of Rainfall at Boston." The contents of the January issue includes a paper on "The Water Works of Porterville, California," also one entitled "Technical Methods of River Improvement, as developed on the Lower Missouri River, by the General Government, from 1876 to 1903."

The Railroad Gazette of January 27, contains a short description of the improvements now being carried on at the Big Four bridge over the Wabash River. The article is accompanied by several illustrations showing the proposed spans, also profiles of the river at the site of the bridge.

The Engineering Magazine for January is a special number, being the third of the labor-saving issues of this magazine. This number is devoted especially to mechanical transport as applied to mining and metal working. The illustrations which accompany the articles are up to the usual standard of excellence and the articles themselves should prove to be of special interest to managers of machine shops, foundries, shipyards and factories.

The January issue of the American Electrician contains a twelve page article by Mr. Laurence B. Mather, entitled "American Water-wheels and Water-wheel Governors." The description is accompanied by sixty illustrations showing the various types of wheels and governors in use at the present time. This number also contains an illustrated description of the American River Electric Company's hydro-electric power and transmission system which is said to be typical of the best water-power plants on the Pacific Coast.

The Baldwin Locomotive Works, of Philadelphia, the largest locomotive plant in the world, during 1904 turned out 1,453 locomotives. Of that number 1,352 were operated by steam, 94 by electricity, and 7 by compressed air. Compared with 1903, this was a reduction of nearly one-third, the number in that year being 2,022, the largest production in the history of the works. Of the locomotives turned out in 1904, 286 were sent to foreign countries.

The California Gas and Electric Corporation, San Francisco, Cal., has just placed an order with the Crocker-Wheeler Company for three 4000-h.p. three-phase, revolving field alternators, to be driven by 6000-h.p. gas engines to be built by the Snow Steam Pump Works. These generators will be the largest in capacity in the world driven by gas engines, and will furnish power to operate the United Railroads of San Francisco. The Snow gas engines, to which they will be direct connected, are the largest in the world for this class of service. They will run at 83 r.p.m., and the generators will deliver 13,200 volts at 25 cycles.—[*American Electrician.*

The Panama Canal Problem.

The Panama Canal is likely to be a very costly undertaking for the United States Government, and the time of its building will probably be equal to that of a generation, if present estimates are right. Chief Engineer Wallace, of the Isthmian Canal Commission, has reported that a sea level water way across the Isthmus, although it would cost far more and take much longer to complete than the three other canal projects under consideration, would in the end be best. In his opinion the cost of the sea level canal would be $300,000,000, as against $200,000,000, for a 90 foot level canal, and he thinks that twenty years would elapse before its completion, or ten years more than for a canal with locks. Here, apparently, is a great opportunity for the development of machinery that shall make as great an advance in such work as was done on the Chicago Drainage Canal. It is imperative that the time of construction be reduced ; every year that its completion is delayed means, in effect, greatly increased cost of construction when the loss to commerce is taken into consideration. It is a chance to put to use on an enormous scale the knowledge gained in hydraulic placer mining in the West. Both the loosening and transportation of the material to the sea might be accomplished rapidly in this manner.—[*Machinery.*

The Brown Wire-wound Gun Tests.

The tests of the six-inch Brown segmental wire-wound gun, 50 calibers long, now going forward at the Government proving grounds at Sandy Hook, are said to have, been so successful that it is claimed a new world's record for heavy ordnance is assured. The Board of Ordnance and Fortification some months ago made an allotment of $41,000 to build and test one of these guns with 250 rounds of ammunition. The *New York World* states that six rounds have already been fired. The initial round, with 32 pounds of powder, produced an initial velocity of 1,913 feet per second. The weight of the charge was increased thereafter, until with 64 pounds of powder a velocity of 3,178 feet per second was attained, with a pressure of 33,450 pounds per square inch. The tests, which are made with smokeless powder, will be continued until 250 rounds have been fired. The velocity attained with the charge in the test of December 7th already establishes a new world's record for this type of gun. It is expected that a velocity of 3,500 feet per second will be attained with a pressure of from 43,000 to 45,000 pounds per square inch. It is stated that the gun will safely withstand the above pressure of 45,000 pounds per square inch, and that consequently the velocity of 3,500 feet per second, which will establish a new world's record, is assured.—[*Journal of the Franklin Institute.*

Proposed Gasoline Electric Motor Car.

In the course of a paper entitled "Developments in Electric Traction," read before the New York Railroad Club, Mr. W. B. Potter, chief of the railway department of the General Electric Company, gave a short description of a proposed new type of motor car now under course of construction by that company. The following is an abstract from the paper as taken from the *Railroad Gazette* :

"The initial expense of electrical equipment, more especially that due to the cost of power station and trolley line, has deterred many steam railroads from electrifying branch lines in sparsely populated districts. Such lines could be served more profitably by independent cars than by steam trains, as the possibility of economically operating single cars on frequent headway, by providing a better service, would have an important influence upon the development of the traffic.

"To meet the requirements of this class of service, a self-propelled car, independent of any feeder system, seems particularly well suited. The principal difficulty that has been experienced with this type of equipment is the insufficient capacity of the engine; and it is not surprising when we appreciate that the motors of a 40 ton electric car under ordinary service conditions are frequently required to develop 500 h. p. during acceleration. The building of a successful car of this description is a problem depending entirely upon the engine; and there seems reasonable grounds for the belief that an engine well adapted to this class of work can be produced.

"The General Electric Company has under construction a gasoline-electric car which, if successful, should be well adapted to meet the requirements of the class of service under consideration. This car is provided with passenger, smoking, toilet and baggage compartments and is 65 feet long over all. The engine room is at one end and a motorman's compartment is provided at each end of the car, to permit it being operated in both directions. The car complete will weigh approximately 55 tons.

"The engine is a six-cylinder Mercedes automobile engine and will have a full load output of 200 brake h. p. and will run at 600 revolutions. It will be direct-connected to a 600-volt generator, the fields of which will be separately excited from an exciter driven by the engine. The controller for the motors will be provided with a series-parallel switch, but no starting resistance, in the usual sense, will be required, as the speed of the motors will be regulated by controlling the voltage of the generator through field resistance points in the controller. The water-cooling system for the engine will be carried through radiators on the top of the car during the summer, and in the winter through the ordinary heater pipes for the purpose of warming the car. An engine of the size proposed will provide for an acceleration sufficient to maintain a schedule speed of 20 to 25 miles where stops are three to four miles apart, and the car can be easily maintained at a running speed of 40 miles. There is no data on which we can accurately base the operating cost of such an equipment, but it seems probable that including all expenses—of the motorman, conductor, fuel and maintenance—the cost will be between 15 to 20 cents per car mile. This will depend somewhat on the daily mileage made by the conductor and motorman, as their wages amount to a considerable portion of the total expense. Reference has been made to this type of equipment, because considerable interest appears to exist regarding the possibilities in this direction, but what measure of success will be attained can only be determined by a thorough trial. Several different types of engines are under consideration, as is also the use of kerosene as a fuel. The object in view is to produce an equipment comparable in some respects to the all-electric car, and at the same time cheaper to operate than the steam trains, which are usually run over the lines for which an equipment of this type is intended.

Electric Smelting Iron Ores.

This process has recently been made the subject of investigation by an expert commission appointed by the Canadian Government, whose study of the subject was directed particularly to the question as it affected the iron ore deposits of Canada. The commission made a tour of the best known iron-smelting furnaces in Europe, and its findings have been embodied in a report which has recently been issued by the Canadian Department of Mines. Its conclusions are summed up in the statement that pig iron can be produced on a commercial scale, at a price to compete with the blast furnace, only when the electric energy is very cheap and fuel very dear. It was found that on the basis assumed in the report, with electric energy at $10 per electric horse-power year, and with coke at $7 per ton, the cost of production is the same as the cost of producing pig iron in a modern blast furnace. Under ordinary conditions, where blast furnaces are an established industry, electric smelting cannot compete, but in special cases, where ample water power is available and blast-furnace coke cannot be readily obtained, electric smelting may be commercially successful. On the other hand, although the cost of electric ore reduction prevents it from competing with either the Bessemer or the Siemens open-hearth process in the production of the common grades of commercial steel, the process was found to be in successful commercial use in the production of high-grade crucible steel.

Now the report of this commission, outside of having fulfilled the immediate purpose for which it was presented, should serve as a safeguard to the general public against being led into hasty and undigested schemes for the smelting of iron ore. The figure of $10 per electric horse-power year can only be realized under very exceptional circumstances, where water is abundant, readily available and contiguous to large deposits of iron ore. We believe that the lowest figures obtainable at Niagara are from $15 to $20 per horse-power, and here, because of the size of the plant, and the unlimited volume and great head of water available, the conditions are ideal for cheap production. It may be that some of the large plants which, during the past few years, have been hurriedly erected on a scale far beyond the immediate local demand for power, are making contracts at prices which give very little, if any, return on the investment; and great care should be exercised in using such low figures as a basis of indiscriminate estimate of the cost of electric iron-ore reduction.—[*Scientific American.*

Lifting Magnets.

The new type of magnet for handling pig iron, small billets, scrap iron or steel, small steel or iron castings, bolts, rivets, etc., in bulk, which has recently been put on the market by The Electric Controller & Supply Co., of Cleveland, Ohio, is the result of long experience and persistent experimenting to get the most efficient design.

It is adapted to be carried on the hook of a crane and controlled by the crane man, who can thus perform the entire operation of loading or unloading a car, or loading melting stock into charging boxes with no ground men or helpers.

This type of magnet has so obviously supplied the demand for a means of materially reducing the cost of handling such raw materials, that the company is experiencing a heavy call for it.

The design of this magnet is radically new and covered by letters patent.

JOHNSON. REED, (Mgr.) FREUDENREICH.

LINDEMAN. THURMAN. TRUEBLOOD (Capt.) DAILY.